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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: G. Taylor

Serial No.: 09/556,285

Filed: April 24, 2000

Group Art Unit: 2811

Examiner: G. Munson

Attorney Docket: OPE-002

Title: A III-V Charge Coupled Device Suitable for Visible, Near and far Infra-red Detection

Honorable Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Sir:

DECLARATION OF GEOFF W. TAYLOR

I, Geoff W. Taylor, hereby declare:

1. I am the inventor of the invention claimed in U.S. Serial No. 09/556,285.

2. I have been granted the following degrees in electrical-engineering: i) B.Sc., Electrical Engineering, Queens University, Kingston, Ont., 1966; ii) M.A.Sc., Electrical Engineering, Univ. of Toronto, Toronto, Ont., 1968; and iii) Ph.D., Electrical Engineering, Univ. of Toronto, Toronto, Ont., 1972.

3. I worked as a member of the technical staff at Bell Labs (now part of Lucent Technologies of Murray Hill, NJ) from June '79 to April '94 and have been a professor in the Electrical and Computer Engineering Department at the University of Connecticut, Storrs, Connecticut, since 1994.

4. The invention claimed in U.S. Serial No. 09/556,285 relate to CCD imaging devices and active-pixel imaging devices, both of which fall within the solid-state imaging arts. Based upon my qualifications outlined in 2. and 3. above, I am representative of one skilled in the solid state imaging arts.

5. The CCD imaging device of the present invention is formed from a series of pixel elements 115 separated by inter-electrode transfer regions 116. Fig. 2 illustrates a cross-sectional view of three pixel elements of the CCD. Fig. 4 illustrates a cross-sectional view of the last pixel element 115, an output gate 115', a differential amplifier (DA), and other circuit elements of the CCD imaging device. Fig. 2 is described in the paragraph that spans pages 9, 10 and 11 of the specification as presented in the preliminary amendment mailed October 2, 2002. Fig. 4 is described in the first full paragraph on page 14 of the specification as presented in the preliminary amendment mailed October 2, 2002.

6. During imaging operations performed by the CCD imaging device of the present invention, charge is accumulated in the storage region 118 of the QW layers 160/159 of the series of pixel elements 115. These imaging operations are described in i) the paragraph spanning pages 11, 12 and 13 of the specification as presented in the preliminary amendment mailed October 2, 2002; ii) the paragraph spanning pages 15 and 16 of the specification as presented in the preliminary amendment mailed October 2, 2002; and iii) the paragraphs on pages 17 and 18 of the specification as presented in the preliminary amendment mailed October 2, 2002.

7. During charge transfer operations performed by the CCD imaging device of the present invention, the accumulated charge is transferred between storage regions 118 of adjacent pixel elements (via passing through the inter-electrode transfer region therebetween and the barrier region 117 of the "charge-receiving" pixel element) in response to clock signals supplied to the electrodes 120 (Fig. 2) of the pixel elements. The voltage levels of the clock signals lower the potential barrier inherently provided by the barrier region 117 of the "charge-receiving" pixel element such that the stored charge flows through the inter-electrode region 116 therebetween and through the barrier region 117 of the "charge-receiving" pixel element. During charge transfer operations, charge is read out of the last pixel element and passes through output gate 115' for supply to the output amplifier DA in response to clock signals supplied to the electrode 120 of the last pixel element 115 and the electrode 120' of the output gate 115' (Fig. 4). The voltage levels of the clock signals lower the potential barrier inherently provided by the barrier region 117' of the output gate 115' such that the stored charge flows through the inter-electrode region 116 therebetween and through the barrier region 117' of the output gate 115'. These charge transfer operations are described in i) the paragraph spanning pages 9, 10 and 11 of the specification as presented in the preliminary amendment mailed October 2, 2002; ii) the paragraph spanning pages 13 and 14 of the specification as presented in the preliminary amendment mailed October 2, 2002; and iii) the paragraph spanning pages 15 and 16 of the specification as presented in the preliminary amendment mailed October 2, 2002. The charge-transfer operations are similar in many respects to those well known in the art, for example as described in U.S. Patent 4,683,484.

8. In the preferred embodiment, a 1.5-phase clocking scheme is used to generate the clock signals that effectuate the transfer of charge between adjacent pixel elements (Fig. 2) in addition to the clock signals that effectuate the transfer of charge from the last pixel element and through the transfer gate 115' (Fig. 4). The 1.5-phase clocking scheme is well known in the solid-state imaging arts. It along with suitable alternative clocking schemes are described in detail in Theuwissen, "Solid-State Imaging with Charge-Coupled Devices", Kluwer Academic Publishers, Chapter 2, March 1995. These clocking schemes are also described in the first full paragraph on page 11 of the specification as presented in the preliminary amendment mailed October 2, 2002.

11. The active-pixel imaging device of the present invention is formed from a pixel element 115 and an output gate 115' separated by an inter-electrode transfer region 116 as

shown in Fig. 4. Fig. 4 is described in the first full paragraph on page 14 of the specification as presented in the preliminary amendment mailed October 2, 2002.

12. During imaging operations performed by the active-pixel imaging device of the present invention, charge is accumulated in the storage region 118 of the QW layers 160/159 of the pixel element 115. These imaging operations are described in i) the paragraph spanning pages 11, 12 and 13 of the specification as presented in the preliminary amendment mailed October 2, 2002; ii) the paragraph spanning pages 15 and 16 of the specification as presented in the preliminary amendment mailed October 2, 2002; and iii) the paragraphs on pages 17 and 18 of the specification as presented in the preliminary amendment mailed October 2, 2002.

13. During the charge transfer operations performed by the active-pixel imaging device of the present invention, the charge flows from the pixel element and through the transfer gate 115' of Fig. 4 as follows. The charge stored in the storage region 118 of the QW layers 160/159 of the pixel element is transferred through the output gate 115' for supply to the differential amplifier (DA) by varying the relative voltage levels applied to the electrode 120 for the pixel element and the electrode 120' of the output gate 115'. Such voltage levels lower the potential barrier inherently provided by the barrier region 117' of the output gate 115' such that the stored charge flows through the inter-electrode region 116 therebetween and through the barrier region 117' of the output gate 115'. These charge transfer operations are described in i) the paragraph spanning pages 9, 10 and 11 of the specification as presented in the preliminary amendment mailed October 2, 2002; ii) the paragraph spanning pages 13 and 14 of the specification as presented in the preliminary amendment mailed October 2, 2002; and iii) the paragraph spanning pages 15 and 16 of the specification as presented in the preliminary amendment mailed October 2, 2002. The charge-transfer operations are similar in many respects to those well known in the art, for example as described in U.S. Patent 4,683,484.

14. In the preferred embodiment, a 1.5-phase clocking scheme is used to generate the clock signals that effectuate the transfer of charge from the pixel element and through the transfer gate 115'. The 1.5-phase clocking scheme is well known in the solid-state imaging arts. It along with suitable alternative clock schemes are described in detail in Theuwissen, "Solid-State Imaging with Charge-Coupled Devices", Kluwer Academic Publishers, Chapter 2, March 1995. These clocking schemes are also described in the first full paragraph on page 11 of the specification as presented in the preliminary amendment mailed October 2, 2002.

15. On my own knowledge and belief, the specification of the present application along with knowledge well known in the art enables one skilled in the art to make and use the quantum-well based solid-state imaging devices as described herein and thus satisfies the requirements of 35 U.S.C. §112, first paragraph.

16. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

8/18/03
Date

Geoff W. Taylor